



CTPP Status Report



U.S. Department of Transportation
Federal Highway Administration
AASHTO Standing Committee on Planning



TRB Census Subcommittee
Bureau of Transportation Statistics
Federal Transit Administration

Census Transportation Planning Products (CTPP) Highlights

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Well it's been quite the year, to say the least! Most recently, we welcomed our new Chair, Sondra Rosenberg of Nevada Department of Transportation (DOT), and bid a huge thanks to outgoing chair Jessie Jones. Jessie led the CTPP with wit, grace, and humor. She also encouraged the board to continue to focus on research, training and data delivery.

As did many things, CTPP went virtual this year. We successfully launched online training in Washington State. CTPP training is now in a live, online model, but remains localized to provide custom-built courses for participants. If you are interested in training for your area, we're ready to deliver. Please contact pweinberger@ashto.org.

We are in the midst of specifying the next CTPP data product. The next data delivery will be based on the 2017-2021 American Community Survey, and expected in late 2023. In the meantime, we are exploring different data delivery methods—including making CTPP data available via API.

In 2020, two Commuting in America briefs were produced, visit

traveltrends.transportation.org to read about the Changing Nature of Work, and Vehicle Availability Patterns and Trends. More briefs to come in 2021.

Stay safe, be well, and use good data.

Modeling the Spatial Pattern of Community Transmission of Coronavirus/COVID-19 from Hot Spot Workplaces to Home

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Transportation has played a significant role in the COVID-19 pandemic—both in terms of transmission of the disease as well in the promise of rapid vaccine delivery worldwide. This work uses the CTPP Flow Data to examine the early stages of the post-Mardi Gras COVID-19 outbreak in Louisiana. Upon examination, the spatial pattern of cases and deaths clearly established the role of commuters in the evolving pandemic.

Background

As evidence from the science, gatherings of large number of people in confined spaces leads to super spreader events. Events like Mardi Gras and the 2020 College Football Championship are super spreader events and lead to high infection and projected deaths.

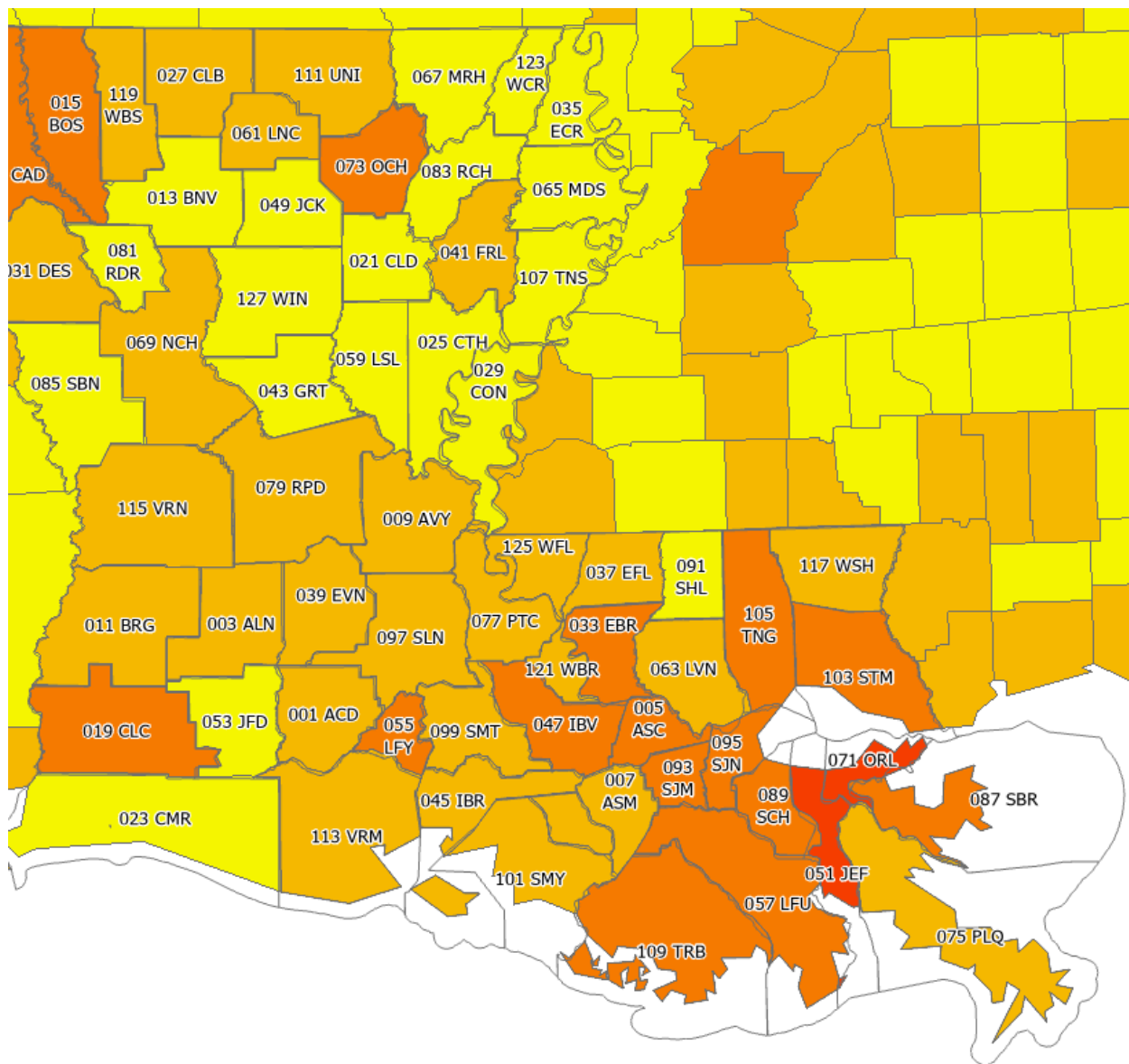


Figure 1. COVID-19 cases reported in and around Louisiana

(Data source: COVID-19 cases reported by the U.S. Department of Health and Human Services, GeoHEALTH website on April 5, 2020)

Figure 1 displays the number of COVID-19 cases reported on April 5, 2020. In this snapshot, it is clear that Parishes adjacent to Orleans Parish (where New Orleans is located) are experiencing elevated infection numbers. However, Parishes located farther away also show increasing numbers, while intervening Parishes show lower numbers. Non-special models that aggregate data at the Parish or State levels, ignore the topological relationships of places (interconnectivity through the transportation network) cannot predict this pattern of

behavior. This work addresses this modeling deficiency, using county-level CTPP Flow Data, to account for movement of the Coronavirus from workplaces in hot spot Louisiana Parishes (counties) into residences of committers to hot-spot Parish.

Selection and Preparation of CTPP Data

During early 2020 the emerging pattern of COVID-19 cases suggested that more than simple proximity was operating to spread the Coronavirus in southeast Louisiana. In fact, the pattern in Figure 1 suggests that

major transportation corridors are common to the Parishes with emerging COVID-19 cases. These include, Interstates 10, 55, and 59, as well as, U.S. 90 and other roadways connecting New Orleans with the ports of southeastern Louisiana. This observation led to the use CTPP Flow Data, to measure daily movement between specified hot-spot Orleans Parish and other emerging areas.

Using the data available from the U.S. Department of Health and Human Services (USDHHS) on a county basis, it was simple to apply the CTPP Flow Data to this problem. For the purposes of this work, only Parishes in Louisiana were used as “Residence” locations and counties in Texas, Arkansas, Mississippi, and Alabama, as well as, Louisiana were used as “Workplace” locations to create analysis data. Merging the USDHHS data with the CTPP data resulted in each record containing a field with the number of commuters from that Parish into a specified hot-spot workplace Parish. Next, a second field was generated, containing the percent of the Parish population represented by the commuters to that hot spot. Also included in the data schema was a field to contain the total number of commuters from all hot-spot Parishes. This field provides an ability to sum the cumulative effect of residents from the Parish that commute daily into various hot-spot workplaces.

It is important to note, in retrospect, that commuting is a bi-directional process. That is, as important as it is to account for the movement of residents into a hot-spot, it is equally important to account for the number of commuters whose origins are a hot spot and work in another Parish. Flows between pairs of origin and destination Parishes are likely bi-directional and asymmetric. The CTPP data can support such an analysis.

The Role of the CTPP Flow Data

The purpose of the CTPP Flow Data is two-fold. First, it provide a metric for the movement of people between specified

locations. This is very important in a pandemic scenario, as it provides a basis for the volume of movement between locales. In the case of the COVID-19 Pandemic, it was clear that people were vectors for transmission. However, the mechanisms involved were less well-known. CTPP Flow Data provides a means to determine the magnitude of interconnectivity. This leads to the second reason for using the CTPP data. It represents a baseline for the movement of people. That is, if no action is taken, this is the “normal” daily travel pattern for commuters. In the absence of any public health measures to limit contact between communities (social-distancing or stay-at-home policies), these travel patterns will persist as a major pathway for transmission of a pathogen, between communities. The CTPP data establish the baseline and the mobility data provide a measure of deviation from “normal” behavior.

Early in the COVID-19 Pandemic, understanding mobility behavior became very important. Little was known about the mechanism(s) that moved the Coronavirus through the population. The only information available to Public Health officials were the numbers of cases, deaths, and related statistics. Cell phone-based, big data techniques were employed to understand transmission of the virus. However, these data were only static, snapshots of mobility. As social behavior changed and the movement of people changed, these “deltas” required validation and calibration to a standard or norm. The CTPP data provide the norm.

Results

The process outlined above builds a dataset for visualization and analysis. This section highlights one example map (Figure 2) describing the locations of hot-spot Parishes and the number of commuters, from other Parishes, into them, as described by the CTPP Flow Data. At the time these maps were produced, mid-April, 2020, it was still early in the course of the COVID-19

Pandemic. At that time, there was still relatively little known about the mechanisms of transmission of the Coronavirus. There were daily reports of the number of cases, the number of deaths, and related statistics. Maps, such as the one depicted in Figure 1, were being produced, daily and patterns began to emerge.

The results, herein, are primarily observational. There remains a great deal of quantitative analysis and modeling to be performed to better understand the utility of commuter data in transmission of the Coronavirus between disparate communities.

Figure 2 depicts the number of commuters from each Louisiana Parish into Orleans Parish (where New Orleans is located). New Orleans is likely the place where the Coronavirus first arrived in the State. The event is held in the streets, bars, and restaurants of the City, where people are closely packed. We now know such events as, “super-spreader” events. For the six to eight weeks preceding February 25, 2020, multiple balls, parades, and other social events were held, where local and tourists mixed, in close proximity.

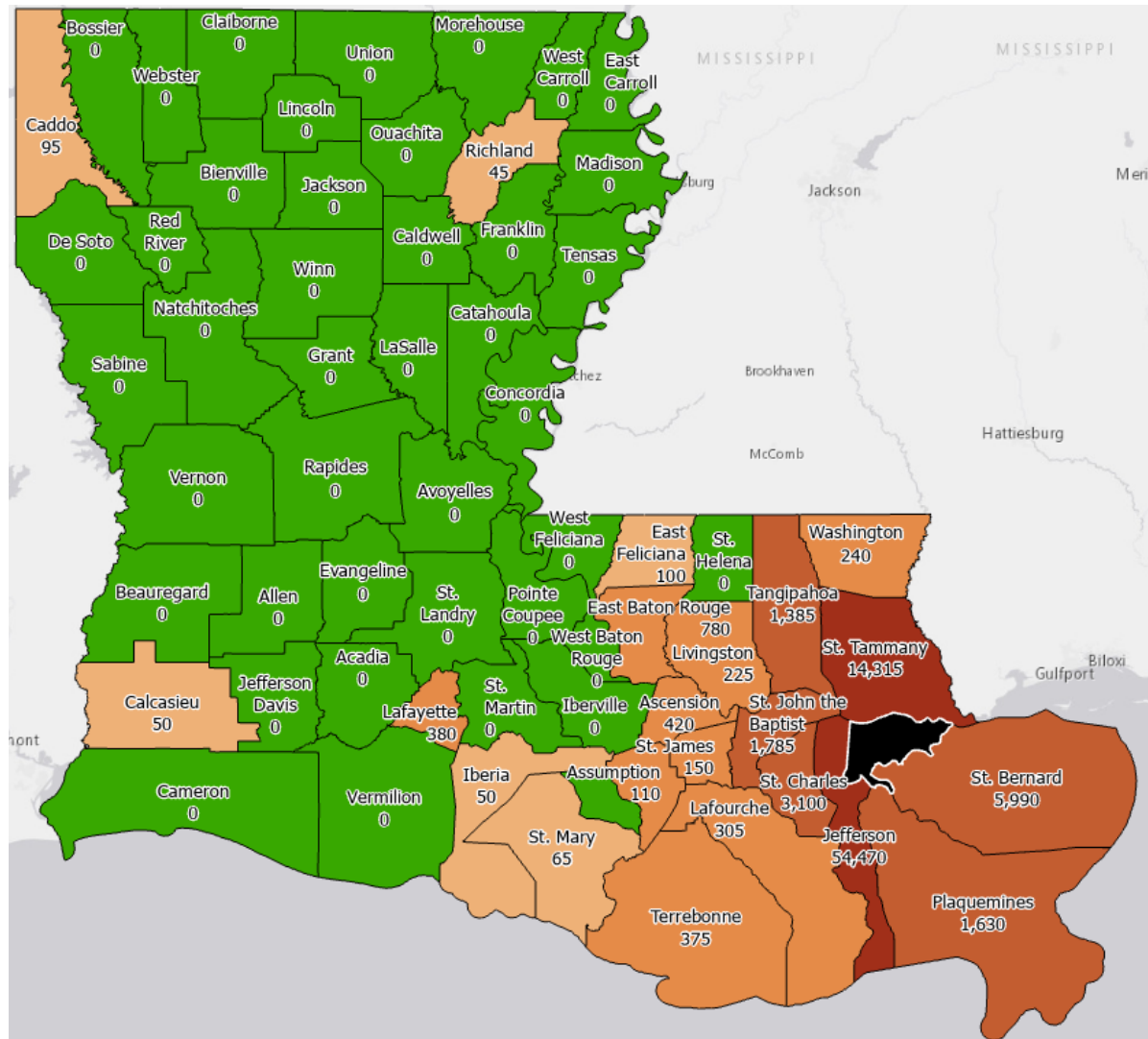


Figure 2. CTPP Flow Data for Louisiana Parishes with commuters who work in Orleans Parish (depicted in black)
(Data Source: 2012-2016 CTPP)

The pattern of 86,065 daily commuters into Orleans Parish resembles the April 5, 2020 pattern of COVID-19 cases in the State. In fact, over the subsequent weeks, Parishes that were not adjacent to Orleans Parish and had relatively high commuter counts in the CTPP Flow Data, started to show elevated numbers of cases. It is important to note that social distancing and stay-at-home policies were not implemented, until mid-March. By that time, the Coronavirus had spread and started a saltatory march across southern Louisiana. Louisiana policies to limit social interactions, stay-at-home policies for all but essential workers, telecommuting, and the closing of schools and various, target business; was very successful, reducing the rate of growth of COVID-19 cases. Without these measures, unhindered spread of the Coronavirus would have continued.

By mid-May, a faltering economy and high unemployment caused business interests to apply pressure on Government officials to “reopen” the State. The Louisiana economy is dominated by the petrochemical and tourism industries, who pushed to drop social distancing and stay-at-home restrictions, by Easter, then by Memorial Day weekend. Starting in June, a four phased reopening plan was implemented by the Governor of Louisiana. Within a few weeks, case counts began to rise. Following the Fourth of July weekend, cases began to spike. By late July, Louisiana had the highest per capita growth rate of COVID-19 cases, in the U.S.

The saltatory movement of COVID-19 cases is mediated, in part, by commuter behavior. The value of the CTPP Flow Data its ability to provide a baseline for “normal” behavior. Reopening represents a return to normal, so the CTPP data can provide a clue to where new cases might arise.

Conclusions

The CTPP Flow Data can be a powerful tool to understand the pattern of infection during a pandemic. It can be used to link the nonspatial, standard methods in practice

within epidemiology and the public health discipline. Specifically, it can provide these models with a means to explain how the pattern of infection, at a specific place and point in time (e.g., g., when a pathogen is introduced into a local population), where the pandemic is likely to move. Nonspatial methods can estimate the proportion of cases in a population, over time. But they cannot predict its movement between populations, in space and time.

The utility of the CTPP Flow Data in pandemic modeling warrants further investigation. Although the early pattern of case counts and deaths were similar to commuter patterns, this work did not attempt to quantify that. There are other areas which merit investigation. This work may be premature. Since the data used in this work was reported, it has come to light that there were various gaps, omissions, and errors in the data collection process. Once the data are corrected and validated, this work should be repeated.

There remain a number of potential applications that should be explored, using the CTPP Flow Data. As a measure of “normality,” these data provide a valuable baseline from which to forecast the movement and magnitude of infection, during early pandemic onset and evolution. How actions and policies might alter the course of a pandemic can be a powerful tool for guiding the response. The proper, a priori, deployment of resources (personnel, medical facilities, personal protective equipment, etc.) are key factors to successfully respond to a pandemic.

A post hoc analysis of the pandemic data should examine factors related to the time series of events. For example, how are the number of or percent of commuters in the population related to:

- Advent of the first case/death*
- Time to first peak (local maxima) in cases/deaths*
- The rate of growth, R_0 , or changes in other key metrics (positive or negative)*

In the absence of social distancing policies, a simple relationship between the number of commuters to and from a hot spot could provide decision-makers with guidance on when and where to deploy resources. This becomes more important when resources are, or become, scarce.

Another area of potential research is to disaggregate the CTPP data into its component transportation modes. In a pandemic, where close social contact is spreads disease, knowing how much of the commuting public uses rail and transit could be important.

Finally, much of today's traffic data are collected in near real time, using cell phone technology and big data methods. In the same sense that the CTPP data provide a baseline for reference and support a priori forecasting, mobility data can be used as a means to track and update progress on social distancing. Correlating changes in these data with changes in case counts, deaths, and other important statistics could provide useful measures of progress toward controlling the pandemic.

Urban Areas for the 2020 Census

Michael Ratcliffe, Vince Osier, Jennifer Zanolini, Jeff Ocker, Michael Commons, and John Fisher, Geography Division, U.S. Census Bureau, geo.urban@census.gov

The Census Bureau's urban-rural classification is fundamentally a delineation

of geographical areas, identifying both individual urban areas and the rural areas of the Nation. The Census Bureau's urban areas represent densely developed territory, and encompass residential, commercial, and other non-residential urban land uses. The Census Bureau delineates urban areas after each decennial census by applying specified criteria to decennial census and other data.

For the 2010 decennial census, the Census Bureau identifies two types of urban areas:

- Urbanized Areas (UAs) of 50,000 or more people.
- Urban Clusters (UCs) of at least 2,500 and less than 50,000 people.

"Rural" encompasses all population, housing, and territory not included within an urban area.

Urbanized areas and urban clusters are defined primarily based on residential population density measured at the census tract and census block levels.

- Initial urban core: at least 1,000 per square mile (386/km²).
- Remainder of urban area: at least 500 per square mile (193/km²).

Table 1 shows the 2010 population distribution by area type. *The Census Bureau identifies urban and rural areas solely for the purpose of tabulating and presenting statistical data.*

Table 1. 2010 Population by area type

	2010 Census Population	2010 Percent
Total	308,745,538	100.0
Urban	249,253,271	80.7
Urbanized Area	219,922,123	71.2
Urban Cluster	29,331,148	9.5
Rural	59,492,267	19.3

The 2020 Urban Area schedule is shown in Figure 3.

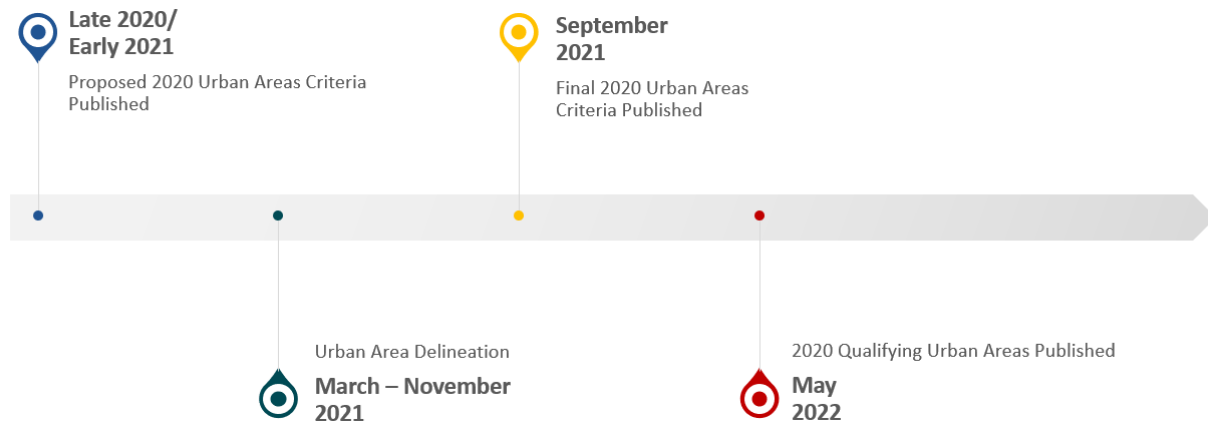


Figure 3. 2020 Urban Area schedule

(Source: Michael Ratcliffe, *Urban Rural for the 2020 Census*, June 18, 2020)

Criteria Changes for 2020

The following are the proposed criteria changes for 2020 for urban area definition.

- Use of housing unit density instead of population density. Proposed density: 385 housing units per square mile.
- Cease distinguishing between urbanized areas and urban clusters. Revise minimum threshold for qualification as an urban area to 10,000 population or 4,000 housing units.
- Reduce the maximum jump distance from 2.5 miles to 1.5 miles. Concern about over-bounding of urban areas. This would be a return to the maximum distance used from 1950 through 1990.
- Do not include hop and jump corridors in the urban area. Will result in noncontiguous territory. This is similar to the approach taken in 1950.
- Use worker flow data from the Longitudinal Employer-Household Dynamics (LEHD) program to determine whether to split large agglomerations and, if so, where to draw the boundary.

The reason for using housing unit density instead of population density is because it provides a more direct measure of the built environment than population density. Further, it also facilitates intercensal updates

of urban areas using data from the Census Bureau's Master Address File.

The introduction of differential privacy also plays a part here. 2020 Census housing unit counts will be invariant. That is, they will not be subject to introduction of noise at the census block-level as part of the differential privacy methodology applied within the Census Bureau's disclosure avoidance system. Finally, housing unit density was used in the delineation of urbanized areas for the 1950 Census. Population density criteria were introduced in 1960.

The reason to cease distinguishing between urbanized areas and urban clusters is because there is no indication in scholarship that 50,000 is a meaningful threshold distinguishing fundamental differences between areas with populations on either side of the threshold. Sub-State population counts from the 2020 Census will be variant; (i.e., noise will be introduced by the disclosure avoidance system). As a result, the total population for any urban area will be the sum of noisy block-level counts. The published population may not be the same as the enumerated population. This allows agencies and data users to easily apply their own thresholds. Consistent with the decision to use housing unit density, the Census Bureau proposes to adopt a 4,000 housing unit threshold as the minimum for identification of an area as urban.

Proposed Criteria for Splitting Large Agglomerations

The automated delineation process results in large agglomerations of continuous, densely developed territory, sometimes encompassing a pair of urban areas, but others encompassing multiple urban areas across multiple States. The Census Bureau proposes to use LEHD worker flow data at the census block-level to determine whether to split large agglomerations and, if so, where to draw the boundary. This provides an objective measure using data contemporaneous with the time of delineation.

The splitting will be a two-stage process that first determines whether 2010 Census urbanized areas qualify to merge based on commuting patterns. If they do not, the second stage uses worker flow data to identify where to split the agglomeration.

- **Stage 1:** Adjacent 2010 Census UAs will be merged if 50 percent or more of the workers in the smaller UA are working in

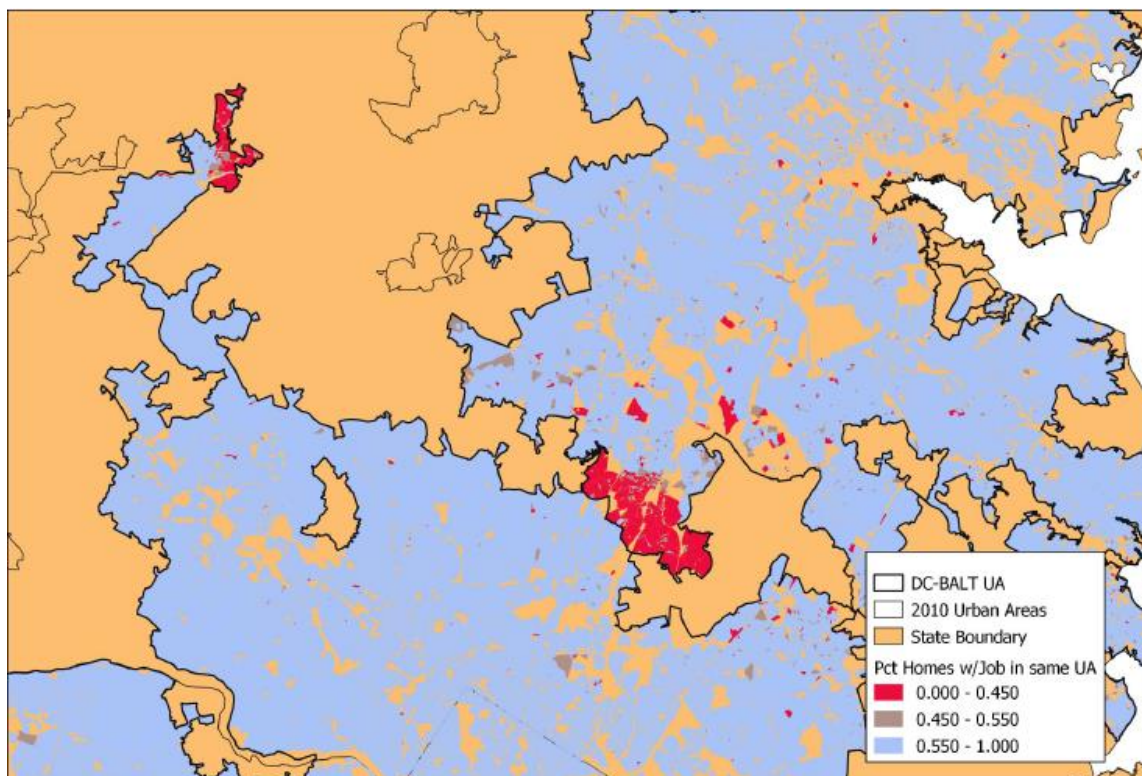
the larger UA and 50 percent or more of the jobs in the smaller UA are filled by workers residing in the larger UA.

- **Stage 2:** Identification of where to split large agglomerations, based on patterns observed by performing “community” detection on the LEHD worker flow data. “Community” boundaries resulting from application of the Leiden Algorithm to the worker flow data will be used to adjust 2010 Census UA split boundaries for the final 2020 Census UAs.

Some examples of the splitting of large agglomerations are given below.

Splitting the Baltimore-Washington Agglomeration

LEHD worker flow data indicate that Baltimore and Washington are distinct “communities.” The blocks in red are within the 2010 Baltimore UA, but most workers living in those blocks work within the Washington area (Figure 4).



Where do Baltimore Residents Work?	Counts	Percent
Baltimore, MD	778,974	78.6%
Washington, DC-VA-MD	149,564	15.1%
Aberdeen-Bel Air South-Bel Air North, MD	14,616	1.5%
Westminster-Eldersburg, MD	7,480	0.8%

Where do Baltimore Workers live?	Counts	Percent
Baltimore, MD	778,974	74.2%
Washington, DC-VA-MD	120,178	11.5%
Aberdeen-Bel Air South-Bel Air North, MD	46,171	4.4%
Westminster-Eldersburg, MD	16,932	1.6%

Where do DC Residents Work?	Counts	Percent
Washington, DC-VA-MD	1,854,172	88.1%
Baltimore, MD	120,178	5.7%
Richmond, VA	26,252	1.2%
Virginia Beach, VA	16,304	0.8%

Where do DC Workers live?	Counts	Percent
Washington, DC-VA-MD	1,854,172	82.0%
Baltimore, MD	149,564	7.0%
Richmond, VA	28,680	1.0%
Virginia Beach, VA	25,987	1.0%

Figure 4. Baltimore-Washington Agglomeration

(Source: Michael Ratcliffe, Urban Rural for the 2020 Census, June 18, 2020)

Splitting Large Agglomerations: New York-Twin Rivers-Hightstown-Trenton-Philadelphia



Where do Concord Residents Work?	Counts	Percent
Charlotte, NC-SC	38,687	43.7%
Concord, NC	31,871	36.0%
Raleigh, NC	2,894	3.3%
Winston-Salem, NC	2,852	3.2%

Where do Concord Workers live?	Counts	Percent
Concord, NC	31,871	46.1%
Charlotte, NC-SC	20,839	30.1%
Winston-Salem, NC	2,132	3.1%
Gastonia, NC-SC	1,612	2.3%

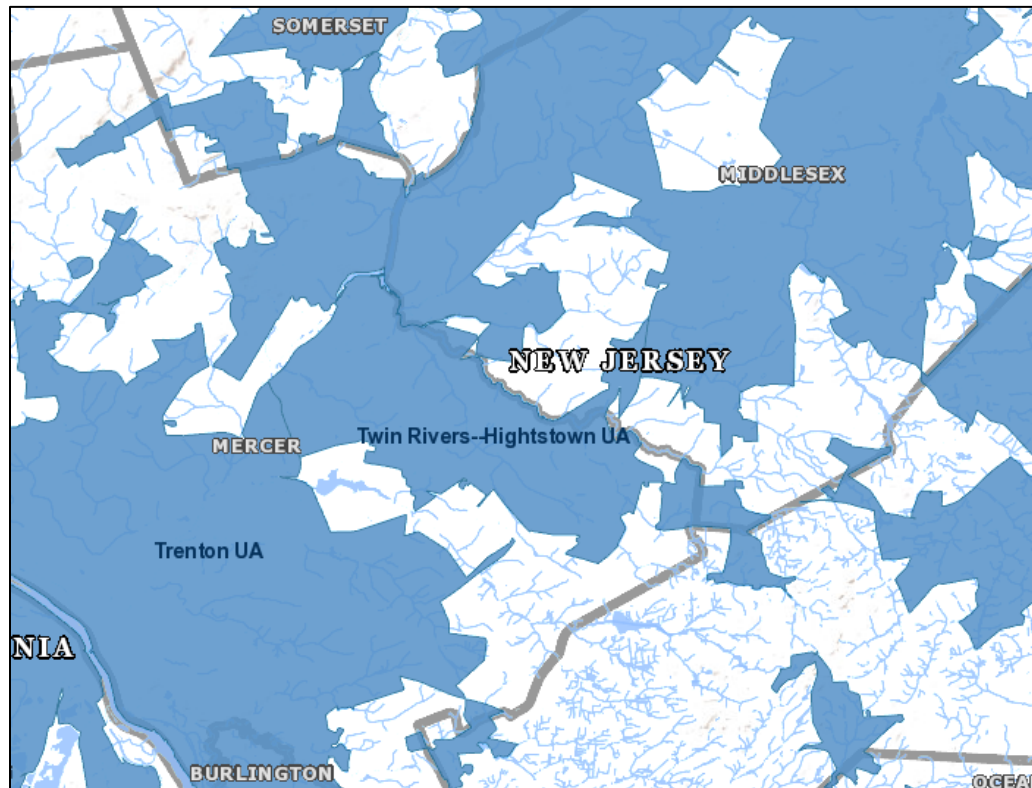
Figure 5. Charlotte Concord Agglomeration

(Source: Michael Ratcliffe, *Urban Rural for the 2020 Census*, June 18, 2020)

Concord is triggered for evaluation. If expansion of the Concord UA into the Charlotte UA (transferring territory from Charlotte UA to Concord UA) does not result in a >50 percent internal flow for Concord before the internal flow for the Charlotte UA is less than 50 percent, then the Concord UA will be absorbed by the Charlotte UA. If the

Leiden algorithm identifies communities in the Charlotte UA that are also in the Concord UA, the split boundary is adjusted and evaluated—if those communities are included in the Concord UA, will the internal commuter flow of Concord exceed 50%, without causing the Charlotte UA to drop below 50 percent internal commuter flow?

Splitting Large Agglomerations: New York-Twin Rivers-Hightstown-Trenton-Philadelphia



Where do Twin Rivers Residents Work?	Counts	Percent
New York-Newark, NY-NJ-CT	17,968	64.3%
Twin Rivers-Hightstown, NJ	3,767	13.5%
Trenton, NJ	3,325	11.9%
Philadelphia, PA-NJ-DE-MD	2,203	7.9%

Where do Twin Rivers Workers live?	Counts	Percent
New York-Newark, NY-NJ-CT	15,828	48.8%
Trenton, NJ	5,865	18.1%
Philadelphia, PA-NJ-DE-MD	5,471	16.9%
Twin Rivers-Hightstown, NJ	3,767	11.6%

Figure 6. New York—Twin Rivers—Hightown—Trenton-Philadelphia Agglomeration
(Source: Michael Ratcliffe, *Urban Rural for the 2020 Census*, June 18, 2020)

LEHD worker flow data indicate strong ties between the Twin Rivers-Hightstown and New York areas, likely resulting in merge of the two 2010 Census urbanized areas (Figure 6). Because the commuter flow is less than 50 percent from NYC to Twin Rivers, this barely makes it to the evaluation stage (instead of staying merged). Being a category 1, we can run the Leiden Algorithm,

and start adding adjacent communities to the Twin Rivers UA, but only until the total housing unit (HU) count increases by 50 percent or less. Likely in this case, internal commuter flow will not reach 50 percent before too many HU are added.

For more questions contact the U.S. Census Bureau at geo.urban@census.gov.

CTPP Contact List

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2012-2016 CTPP Data: <https://ctpp.transportation.org/2012-2016-5-year-ctpp/>

CTPP website: https://www.fhwa.dot.gov/planning/census_issues/ctpp/

FHWA website for Census issues: https://www.fhwa.dot.gov/planning/census_issues

AASHTO website for CTPP: <https://ctpp.transportation.org>

2006-2010 CTPP Data: <https://ctpp.transportation.org/ctpp-data-set-information/5-year-data/>

1990 and 2000 CTPP data downloadable via Transtats: <https://transtats.bts.gov/>

TRB Subcommittee on census data: <http://www.trbcensus.com>

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CTPP Listserv

The CTPP Listserv serves as a web-forum for posting questions and sharing information on Census and ACS. Currently, more than 700 users are subscribed to the listserv. To subscribe, please register by completing a form posted at: <http://www.chrispy.net/mailman/listinfo/ctpp-news>.

On the form, you can indicate if you want emails to be batched in a daily digest. The website also includes an archive of past emails posted to the listserv.